WHAT IS CLAIMED IS:

1. A multi-stage process for the continuous preparation of thermoplastically processable polyurethane elastomers (TPU) with tensile strengths of > 30 MPa (measured in accordance with EN ISO 527-3), comprising

a) preparing a prepolymer I by reacting

A) at least one organic diisocyanate,

with

B) a polyol 1 having on average at least 1.8 and not more than 3.0 Zerewitinoff-active hydrogen atoms and a number-average molecular weight $\overline{M}_n$ of 450 to 10,000;

b) reacting said prepolymer I prepared in a) with

C) a polyol 2, which is different than polyol 1, wherein said polyol 2 has on average at least 1.8 and not more than 3.0 Zerewitinoff-active hydrogen atoms and a number-average molecular weight $\overline{M}_n$ of 60 to 10,000,

to yield a prepolymer II, wherein an equivalent ratio of NCO groups to the sum of NCO-reactive groups of from 1.2:1 to 10:1 is established, based on reaction components (A), (B) and (C);

c) reacting, in a high-viscosity reactor operating with a high shear energy, said prepolymer II prepared in b) completely with:

D) at least one low molecular weight polyol or polyamine having on average at least 1.8 and not more than 3.0 Zerewitinoff-active hydrogen atoms and a number-average molecular weight $\overline{M}_n$ of 60 to 400 as a chain lengthener;

wherein steps a) to c) are optionally carried out in the presence of F) catalysts, and optionally, with the addition of E) 0 to 20 wt.%, based on the total amount of TPU, of further auxiliary substances and additives, with the overall equivalent ratio of NCO groups to the sum of NCO-reactive groups being from 0.9:1 to 1.2:1, based on the sum of all the reaction components of steps a) to c).

2. The process of Claim 1, wherein B) said polyol 1 and C) said polyol 2, both of which contain Zerewitinoff-active hydrogen atoms, are selected from the group consisting of (i) polyester-polyols, (ii) polyether-polyols, (iii) polycarbonate-polyols, (iv) polyols which contain nitrogen, phosphorus, sulfur and/or silicon atoms and (v) mixtures thereof.

3. The process of Claim 1, wherein D) said low molecular weight polyols containing Zerewitinoff-active hydrogen atoms comprises ethylene glycol, butanediol, hexanediol, 1,4-di-(β-hydroxyethyl)-hydroquinone, or 1,4-di-(β-hydroxyethyl)-bisphenol A.

4. The process of Claim 1, wherein A) said organic diisocyanate comprises an aromatic diisocyanate.

5. The process of Claim 4, wherein said aromatic diisocyanate comprises a diphenylmethane-diisocyanate isomer mixture having a 4,4'-diphenylmethane-diisocyanate content of > 96 wt.%.

6. The process of Claim 1, wherein C) said polyol 2 which contains Zerewitinoff-active hydrogen atoms comprises an organic phosphorus-containing compound having on average at least 1.5 and not more than 2.5 Zerewitinoff-active hydrogen atoms and having a number-average molecular weight $\overline{M}_n$ of 100 to 5,000, in an amount of 0.01 to 50 wt.%, based on the total amount of TPU.

7. The of Claim 1, wherein steps a) and b) are carried out in separate reactors.

8. The process of Claim 1, wherein step c) is carried out in a separate reactor than steps a) and b).

9. The process of Claim 1, wherein step c) is carried out in a multi-screw extruder.